PRELIMINARY PUBLIC HEALTH ASSESSMENT

ST. LOUIS AIRPORT
HAZELWOOD INTERIM STORAGE/FUTURA COATINGS COMPANY
ST. LOUIS, ST. LOUIS COUNTY, MISSOURI
CERCLIS NO. MOD980633176

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Prepared by:

DIVISION OF HEALTH ASSESSMENT AND CONSULTATION
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

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Query Form

The Superfund Query Form allows you to retrieve data from the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) database in Envirofacts. Specify a facility by using any combination of facility name and geographic location. You may also select an output option.

Additional Superfund Site information may be obtained through EPA's Superfund web site. Their query pages provide an alternative method for retrieving Superfund Site information.

User's Guide

Facility Selection

Facility Identification: Facility Name (Enter a partial or complete Facility Name)

Facility Identification Option Value:

(•) Beginning With ( ) Exact Match ( ) Containing

Geography Search

Enter a partial value for any geography option except for the state value. We strongly recommend that you enter a small geographical area to begin the search since Envirofacts contains a large number of facilities.

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Address:

(•) Beginning With ( ) Exact Match ( ) Containing

City:

County:

State:

EPA Region:

[ ] National Priority List (NPL) Sites Only
(This includes sites which are proposed or are currently on the list, or were previously on the NPL)

Search Values

(•) Use Multisystem facility information to perform facility search
( ) Use CERCLIS facility information only to perform facility search

Output Selection

- (•) Basic Facility Information
- ( ) Facility Detail Information

Search Clear

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SUMMARY

The St. Louis Airport/Hazelwood Interim Storage/Futura Coatings Company, a National Priorities List site, is in St. Louis County, Missouri. The site, a U.S. Department of Energy (DOE) Formerly Utilized Sites Remedial Action Program (FUSRAP) activity, is near the St. Louis International Airport and the McDonnell Douglas Corporation. From 1946 to 1973, the site was used to store radioactive materials resulting from uranium processing. High levels of uranium, thorium, radium, and radon were detected in soil, groundwater, and air. The site is still being used to store radioactive materials. The Agency for Toxic Substances and Disease Registry considers the St. Louis Airport site to be an indeterminate public health hazard. Although there are emissions of radon and the presence of thorium in on-site air and off-site soils and the emission of radiation resulting from the presence of these materials is not currently considered a health hazard. At present conditions, the concentration of radon off-site is indistinguishable from background levels. However, in the past, these contaminants may have been present at levels of health concern.

Citizens have concerns regarding cases of cancer reportedly found among residents living near five hazardous waste sites. These citizens requested the Missouri Department of Health to investigate cancer occurrences in the area of the sites. The results of the health statistics review and cancer inquiry by the Missouri Department of Health appear in the Public Health Implication section. ATSDR's detailed response to comments and concerns received during the public comment period appear in the Appendix C.

ATSDR made the following recommendations in order to protect public health in areas surrounding the sites: 1) characterize groundwater, surface water, sediment, and soil for chemical contamination on and off site, 2) characterize off-site surface soil and air for radiological contaminants, 3) implement dust controls during remediation. The Health Activities Recommendation Panel recommended this site for follow-up health studies and for community health education follow up. The Public Health Actions section describes which actions have been taken and which actions are planned by ATSDR and other federal or state agencies. Included in these actions is that ATSDR will review additional off-site soil and groundwater data when available from DOE and the Missouri Department of Health will periodically conduct follow-up assessments of the cancer incidence in the Hazelwood, Latty Avenue areas of St. Louis.

BACKGROUND

A. Site Description and History

The St. Louis Airport/Hazelwood Interim Storage/Futura Coatings Company site is in St. Louis County, Missouri. The site, which is composed of three smaller storage areas, was combined by the U.S. Environmental Protection Agency (EPA) into the present National Priorities List (NPL) site. These areas were the St. Louis Airport Storage Site (SLAPS), the Hazelwood Interim Storage Site (HISS) and the Futura Coatings Company site (FUTURA) (Figure 1). The HISS and FUTURA areas share common facilities. These three facilities were grouped together because of similarities of contaminants; proximity to each other; contaminated haul roads, including portions of Hazelwood Avenue, Pershall Road, and McDonnell Boulevard, between the areas; and air release of radon-222 (Rn-222). The sites also show the possibility of

similar threats to public health (Mitre, 1988). The areas are also listed on the Department of Energy (DOE) Formerly Utilized Sites Remedial Action Program (FUSRAP).

The SLAPS is the largest of the three areas, covering 21.7 acres, and is approximately 15 miles northwest of downtown St. Louis. To the south is Banshee Road and a Norfolk and Western Railroad line, to the west is Coldwater Creek, and to the north and east is McDonnell Boulevard. Next to the SLAPS is the St. Louis International Airport on the south. The Berkeley Khoury League Park is to the north, and the McDonnell Douglas Corporation is to the west and southwest. The SLAPS slopes to the west toward the creek, which is about 20 feet below the site and 500 feet above mean sea level (Figure 2).

The HISS and FUTURA areas, which cover about 11 acres, are approximately 0.5 mile from SLAPS and approximately 2 miles northeast of the St. Louis Airport control tower. They are bounded on the north by Latty Avenue; on the east by the city of Berkeley; on the south by Hazelwood, the Norfolk and Western Railroad, and a tributary of the Coldwater Creek; and on the west by Coldwater Creek (Figure 3). The associated off-site locations collectively known as the Latty Avenue Vicinity Properties. Businesses located along Latty Avenue are adjacent to the HIS and Futura sites are shown in Figure 4.

In 1946, the area was acquired by the Manhattan Engineering District of the U.S. Army and used to store uranium wastes generated by the Mallinckrodt operation in St. Louis. Wastes stored at these sites also included scrap metals, drums, covered piles, and unstabilized piles of waste generated during uranium-processing activities. At the SLAPS, the uranium-processing wastes were stored on open ground and once covered two-thirds of the area to an estimated height of 20 feet. In 1957, contaminated scrap metal and miscellaneous radioactive wastes were buried on the west portion of the SLAPS (USDOE, 1986a). In 1966, after the Continental Mining and Milling Company (CMM) purchased the property, the wastes were transferred from the SLAPS to the HISS. In 1967, CMM sold the property and wastes to the Commercial Discount Corporation of Chicago. The waste was then dried and shipped to the Cotter Corporation in Colorado. In December 1969, the Cotter Corporation purchased the remaining wastes at the HISS and shipped some material to Colorado. By late 1970, approximately 19,000 tons of uranium-processing waste (raffinate) and barium sulfate remained at the site. By 1973, most of the wastes were transferred to the Latty Avenue areas and the residual processing wastes had been removed to the Cotter Corporation in Canon City, Colorado.

Besides the wastes still present at the NPL site, additional wastes were moved to either the Weldon Springs Quarry NPL site, also in Missouri, or to the West Lake Landfill in St. Louis County. During the latter part of the 1960's, the SLAPS land was transferred to the St. Louis Airport Authority, which partially remediated a portion of the area. The remediation included demolishing existing buildings and burying the wastes on-site. The area was covered with about 3 feet of clean fill during 1969. In 1977, the responsibility for the property, but not ownership, was returned to the DOE that was formed from the breakup of the Atomic Energy Commission (USDOE, 1986b).

Further remediation of the HISS and FUTURA area in 1977 generated 13,000 cubic yards of contaminated material that were placed in a pile at the HISS area. Later, in 1979, the Nuclear Regulatory Commission (NRC) released the property for unrestricted use. In 1982, the HISS and FUTURA areas were placed on the DOE FUSRAP list. Also in 1982, ditches surrounding the SLAPS were sampled by Bechtel National, Inc. The results of this sampling delineated the limits of the uranium-238 (U-238) and radium-226 (Ra-226) contamination.

During 1984, additional remediation at Latty Avenue locations generated another 14,000 cubic yards that were stored in a supplementary pile at HISS (Bechtel, 1987a). Also during this time, a vehicle decontamination area was constructed, the area was fenced, and the waste piles were consolidated.

In 1985, the DOE was authorized to reacquire the SLAPS site (Public Law 98-360) and use it as a permanent disposal site for the waste existing on the site at that time. Also, contaminated soils from ditches surrounding the site and wastes stored at HISS were to be stored at the site. Erosion along the SLAPS was reduced by

installing rock-filled structures along the western edge of the site. At Latty Avenue locations, monitoring wells were installed. The DOE also directed the Oak Ridge National Laboratories (ORNL) to survey the haul roads between these storage areas. On the basis of this survey, the major contaminant detected was thorium-230, (Th-230) and the portions of the haul roads to be remediated were determined. These areas included portions of Hazelwood Avenue, Pershall Road, and McDonnell Boulevard.

In 1986, the roads leading to these areas were improved and during this action, additional contaminated soils were removed from the area. Also, boreholes were drilled at the SLAPS to define the nature and extent of the contamination (USDOE, 1986a,b).

The total amount of the wastes believed to have been stored at the SLAPS is 125,150 tons, of which 241 tons were believed to be uranium, either naturally occurring (U-nat) or uranium-238 (U-238). Of this amount, the wastes perhaps consisted of 106,500 tons of raffinate, 10,200 tons of leached or unleached barium sulfate, 4,000 tons of dolomite and magnesium fluoride, 3,500 tons of scrap metal, 600 tons of U-containing sand and other contaminated materials in 2,400 drums, and 350 tons of miscellaneous wastes (Mitre, 1988).

In late 1989, the Army Corps of Engineers (COE) requested that DOE survey an additional portion of Coldwater Creek. The information garnered from this survey was used in preparing the COE's Coldwater Creek flood control project.

B. Site Visit

The Agency for Toxic Substances and Disease Registry (ATSDR) conducted a site visit on February 5, 1990. Participating in this visit were an ATSDR health physicist, a representative from the State of Missouri Department of Health, representatives from DOE and its contractor, Bechtel National, Inc., and a representative from EPA. During the site visit, a tour of the NPL site and off-site environs was given as well as a historical perspective of the operations resulting in the formation of the SLAPS.

C. Demographics, Land Use, and Natural Resource Use

The SLAPS site is located approximately 10 miles northwest of downtown St. Louis in the suburban town of Hazelwood. Lambert Airport is immediately south of the site. The three areas comprising the NPL site are in a commercial and industrial area. The McDonnell Douglas Corporation is within 0.5 mile of the site and employs approximately 33,000 people. Runways from the St. Louis Airport terminate near the SLAPS boundary on the southwest edge of the site. The community closest to any one of the three areas is Hazelwood, Missouri, at a distance of less than 0.3 mile from HISS.

The six census tracts which lie within roughly 1 mile of the site had a total 1990 population of 26,657; this represents a decline of nearly 14 percent from the 1980 population of approximately 31,000. The tract containing the site had a population of 4,093 in 1990.

The 1990 population of the six tracts was 52.6 percent female and 47.4 percent male. The 1990 racial makeup of this area was 68 percent white, 31 percent black, and only 1 percent other races; however, the population of the tract containing the site was over 84 percent black. Less than 1 percent were of Hispanic origin. Approximately 14 percent of all persons were under 10 years of age, while just over 12 percent were age 65 or older.

There were 10,399 occupied units in the six tracts for an average of 2.56 persons per household. In the tract containing the site there were 1,273 occupied housing units for 3.22 persons per household. Median value of owner occupied housing units ranged from $38,400 to $87,500 for the six tracts, $47,100 for the tract with the site; this figure is suggestive of a lower income neighborhood. Nearly 70 percent of occupied housing units were owner occupied.

A recreational area, Berkeley Khoury League Park, is to the north of the SLAPS and is contaminated with

radioactive wastes previously stored at this site.

Coldwater Creek forms a site boundary and is not used for any recreational activities in the vicinity of SLAPS. However, since the creek is about 19 miles in length, it is conceivable that some neighborhood may use it for recreational purposes and that some parks with recreational activities may occur along the creek. The nearest well is believed to be about 1.5 miles north of the SLAPS; however, no data are available to suggest if this well serves as a source of drinking water. There are no agricultural activities near the areas (Mitre, 1988).

D. Health Outcome Data

Health outcome databases document health effects that occur in populations. Those data, which come from sources such as state tumor registry databases, birth defects databases, vital statistics records, or other records, may provide information about the general health of the community living near a site. Other more specific records, such as hospital and medical records and records from site-specific health studies, may be used. Demographic data provide information on population characteristics are used to analyze health outcome data.

The Missouri Department of Health (MDOH), State Center for Health Statistics, analyzes and consults on health related information collected from several sources. The Center's Bureau of Health Data Analysis has available statistical information, hospital discharge data, and the Multi-Source Birth Defect Registry. The Multi-Source Birth Defect Registry consists of birth outcome data from the following sources: birth, death, hospital discharge Crippled Children's Services, and Neonatal Intensive Care Unit records.

Missouri Cancer Registry (MCR) database is a repository for all newly diagnosed cancer reported to MCR. MCR data is available from 1984 when the law mandated reporting of new cancer cases. This data is not population-based.

The Missouri Department of Health, Division of Chronic Prevention and Health Promotion, Bureau of Smoking, Tobacco, and Cancer has a cancer inquiry process. This process is designed to ensure that excess cancer reported to the Bureau of Smoking, Tobacco, and Cancer are reviewed systematically in the preliminary review phase and are presented to the Cancer Inquiry Committee. The committee can recommend either the study be discontinued or the inquiry be expanded into an investigation phase.

COMMUNITY HEALTH CONCERNS

This site has posed many concerns for the health and safety of the residents in St. Louis. In 1987, the ATSDR released a health consultation, but could not adequately address the site then because of limited data. In that same year, a private citizen's letter to the U.S. Senators and Representatives of the region expressed concerns about the high concentrations of radioactive materials detected in soils, sediments, and the Coldwater Creek environs.

In 1988, the St. Louis Board of Aldermen passed a resolution stating their reluctance "that a permanent radioactive waste site near the airport would be in the best interest to area citizens or the local environment." The Board additionally remained opposed to releasing the title from the city to DOE for the purposes of site expansion (Resolution 146) unless specific conditions were met. In 1990, the Board of Aldermen voted to offer 81 acres near the airport to the DOE (St. Louis Post-Dispatch, February 5, 1990).

Citizens in this area of Hazelwood requested the Missouri Department of Health to investigate these cancer occurrences in the area and at other FUSRAP sites in the St. Louis area. In 1988 a citizen requested a health study of persons living near five sites in St Louis area. In 1989 a concerned citizen contacted the Missouri Department of Health regarding several cases of cancer reportedly found among the residents in the homes

closest to the HISS.

On April 29, 1991, ATSDR issued a news release announcing the availability of the health assessment for this site. The Public Comment Period, in which citizens could obtain and comment on the health assessment, ran from May 15 to June 13, 1991. The announcement, a newspaper article concerning the study, and comments received by ATSDR are given in Appendix B. Personal identifiers, except for governmental agencies or national interest groups, were deleted from the material in the appendix. The agency response to the comments are given in Appendix C.

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ENVIRONMENTAL CONTAMINATION AND OTHER HAZARDS

A. On-Site Contamination

Environmental monitoring locations for the SLAPS, HISS, and FUTURA areas are shown in Figures 5 and 6. Results of on-site sampling performed by the NRC, ORNL, and a DOE contractor found significant levels of radioactive materials in the groundwater, soils, and air. The contaminants detected were U-238, U-nat, Th-230 and Th-232, Ra-226, and radon (isotope not specified). The levels detected were in excess of the regional isotope background (bkg) values for the St. Louis area as determined by the DOE. Although there is no surface water at the NPL site that could be contaminated, Coldwater Creek forms a boundary of the site (Figure 1) and contaminated surface runoff has entered the creek (Mitre, 1988).

Groundwater

Monitoring wells were located along the periphery of the site. Sampling results of these on-site groundwater monitoring locations at the SLAPS from 1981 to 1982 showed elevated levels of U-238. The yearly average during this time was approximately 439 picocuries per liter (pCi/L) (one picocurie equals 10^{-12} curies), with the highest well averaging an excess of 1,851 pCi/L during this time. Radium-226 and Th-230 were also detected in the groundwater. These monitoring results showed average concentrations for Ra-226 and Th-230 of 0.64 pCi/L and 0.8 pCi/L, respectively. The highest concentrations detected showed levels of 1 pCi/L for Ra-226 and 1.8 pCi/L for Th-230.

In 1988, groundwater monitoring at SLAPS showed the concentrations of total uranium ranged from background (bkg) to over 5,500 pCi/L, for Ra-226 the concentrations ranged from bkg to about 1 pCi/L, and for Th-230 the concentrations ranged from bkg to over 50 pCi/L at on-site locations (Bechtel, 1989a). At HISS, groundwater samples from the site showed uranium concentrations ranging from bkg to 87 pCi/L, Th-230 from bkg to 64 pCi/L, and Ra-226 from bkg to 3.7 pCi/L (Tables 1, 2).

Surface Water

Surface water sampling in Coldwater Creek by the SLAPS showed the maximum concentration of total uranium, including background, was 4 pCi/L. The concentrations of Th-230 and Ra-226 were at or below bkg (Bechtel, 1989a). Surface water measurements for radionuclides at the HISS showed the presence of total uranium ranging from bkg to 5 pCi/L, Th-230 ranging from 0.1 to 0.9 pCi/L, and Ra-226 ranging from 0.1 to 0.3 pCi/L (Tables 1, 2).

Sediment

Sediment sampling at the SLAPS for total uranium, Th-230, and Ra-226 showed maximum concentrations of 1.7 pCi/g, 4.1 pCi/g, and bkg, respectively (Bechtel, 1989a) (Table 1). Sediment sampling at the HISS for total uranium, Th-230, and Ra-226 showed average concentrations of 1.7 pCi/g, 4.8 pCi/g, and 1.2 pCi/g, respectively (Table 2) (Bechtel, 1989b).

Air

Airborne contamination at these areas consists of both gamma radiation and Rn-222. The amount, or intensity, of gamma rays depends on the type of radioactive material at the site, its concentration and depth from the surface, and physical distribution in the soil. This intensity results in an exposure rate. Measurements of the gamma ray exposure rate were made with a pressurized ionization chamber. The Rn-222 concentration is dependent on the amount of Ra-226 present, since Rn-222 is the first decay product produced during decay of the Ra-226. Airborne measurements for Rn-222 were the average of 25 stations determined by alpha track detectors. The bkg station was 5 miles from the areas.

At the SLAPS, the gamma exposure rate has been measured at 9 to 261 x 10^{-6} roentgens per hour (R/hr, a roentgen is a unit of radiation exposure), with an average of 84 x 10^{-6} R/hr taken along the northern boundary (Bechtel, 1987c). In 1988, gamma radiation measurements showed a radiation exposure rate ranging from 17 to 2,229 x 10^{-3} R/yr above a bkg average of 73x10^{-3} R/yr (Bechtel, 1989a).

At the HISS area, the exposure rate was 13 to 55 x 10^{-6} R/hr, with an average of 24 x 10^{-6} R/hr. The exposure rate at the FUTURA site was 8 to 27 x 10^{-6} R/hr outside existing structures. The bkg in the St. Louis area was 8 x 10^{-6} R/hr. Gamma radiation readings at the site during 1988 ranged from 13 to 55 x 10^{-6} R/hr with an average exposure rate of 24 x 10^{-6} R/hr with the bkg in the St. Louis area of 8 x 10^{-6} R/hr.

Rn-222 measurements at the SLAPS site, including the bkg of 0.3 pCi/L, ranged from bkg to 6.8 pCi/L with a maximum average of 3.4 pCi/L. Results from the HISS ranged from bkg to 3.4 pCi/L with a maximum average of 1.8 pCi/L. Because gas emanation is dependent on atmospheric temperature and pressure, there were seasonal variations in the measurements. Rn-222 at the SLAPS for 1988 ranged from 0.3 to 4.6 pCi/L, including a bkg reading ranging from 0.3 to 0.6 pCi/L. Background sampling locations were located a minimum of 0.5 mile from the site. The average Rn-222 concentration at the site from 1984 to 1988 has ranged from 0.1 pCi/L to 3.6 pCi/L (Bechtel, 1989a). The DOE limit for FUSRAP sites is 3 pCi/L.

Ra-222 at the HISS for 1988 ranged from 0.3 to 2.4 pCi/L, including a bkg reading ranging from 0.3 to 1.0 pCi/L. Background sampling locations were located a minimum of 5 miles from the site. The average Rn-222 concentration at the site from 1984 to 1988 has ranged from 0.2 pCi/L to 2.2 pCi/L (Bechtel, 1989b).

Soils

In a limited characterization for nonradioactive materials present at the SLAPS area, no elevated levels of total organic halogens were detected in soils. This would suggest a lack of or very small amounts of halogenated organic compounds such as pesticides, polychlorinated biphenyls, or solvents. However, three samples suggested the presence of total organic carbon, present at a level of 1 percent. The analysis of soils for heavy metals suggested the presence, above bkg, of selenium (93 ppm), beryllium (190 ppm), nickel (5,800 ppm), copper (2,300 ppm), cobalt (4,600 ppm), tin (4,400 ppm), molybdenum (150 ppm), magnesium (19,000 ppm), thallium (33 ppm), lead (580 ppm), antimony (2,300 ppm), and cadmium (3.5 ppm) (Bechtel, 1987c). The depths at which these samples were collected were not given. Of these heavy metals, selenium and lead appear to pose a potential health risk.

The concentrations of radioactive materials at the SLAPS include uranium (1,600 pCi/g), Th-230 (2,600 pCi/g), Th-232 (63 pCi/g), and Ra-226 (5,600 pCi/g) (Table 1) (Bechtel, 1987c).

The radionuclides detected at the HISS as determined by actual soil analysis included U-238 (800 pCi/g), Th-232 (0.7-5 pCi/g), Th-230 (790 pCi/g), and Ra-226 (700 pCi/g) (Table 2) (Bechtel, 1987a). The average depth of the contamination was 3 feet with the deepest contamination of 6 feet at one location within the site (Bechtel, 1987a).

Soil measurements collected at the FUTURA area indicated the presence of uranium (2,500 pCi/g), Th-230 (2,000 pCi/g), Th-232 (26 pCi/g), and Ra-226 (2,300 pCi/g) (Bechtel, 1987b).

Currently, biota measurements have not been collected on-site.

B. Off-Site Contamination

Off-site areas associated with this site include Coldwater Creek and the road systems used to haul radioactive materials to the SLAPS area and from the SLAPS to the HISS and FUTURA areas. Additional off-site locations include the Berkeley Khoury League Park (Figure 2); properties next to the site, collectively known as the Latty Avenue Properties (Figure 4); the Norfolk and Western Railroad property; and portions of property near the SLAPS location including ditches, Banshee Road, and portions of land owned by the St. Louis Airport Authority.

Soil

Sediments and soils from Coldwater Creek were collected before 1989 by Bechtel. These samples were analyzed for the presence of radioactive materials. The results of sediment sampling show the presence of U-238 (4.8 pCi/g), Th-232 (1.5 pCi/g), Th-230 (110 pCi/g), and Ra-226 (3.1 pCi/g). Of these values, only Th-230 was above the DOE guidelines for FUSRAP locations. Surface soils from along the creek bank suggested the presence of U-238 (78 pCi/g), Th-232 (5 pCi/g), Th-230 (5,100 pCi/g), and Ra-226 (71 pCi/g) (Bechtel, 1990).

During 1989, the COE requested that additional soil plug samples be collected along the banks of Coldwater Creek. These samples were collected beginning at the termination point of the Bechtel study and proceeded for an additional 4.8 miles along the banks at 500 foot intervals. The top 6 inches of the soil plug were also analyzed for U-238, Th-232, Th-230, and Ra-226. The results of these sampling activities showed the maximum concentrations (above background) of U-238, Th-232, Th-230, and Ra-226 were 12.9 pCi/g, 4 pCi/g, 27.7 pCi/g, and 2.4 pCi/g, respectively. Of these levels, Th-230 exceeded the DOE clean-up levels. It has not been determined if the concentration of uranium in this survey exceeds guidelines since the guidelines are still being formulated for the St. Louis area (FUSRAP, 1989).

The results of soil sampling from over 60 properties located along the haul roads have been reviewed and summarized. The maximum levels detected and the corresponding depths are given in Table 4 (Bechtel, 1990). The contamination was mostly confined to a depth of a foot over the haul roads. Along Latty Avenue, however, in one area, the contamination was found as deep as 7 feet. The survey along McDonnell Boulevard suggested the contamination in one location was at least 15 feet deep and over 1300 feet in length. In one isolated area near the intersection of Eva Avenue and McDonnell Boulevard, the contamination was found to a depth of 5 feet. Along Hazelwood Avenue, the contamination was spread from the intersection of Frost Road to Pershall Road. Contamination along Pershall Road was found at an average depth of 3 feet, with an isolated area contaminated to a depth of 13 feet (Bechtel, 1990).

The results of sampling supplied from the Latty Properties were for near surface (12 inches above the surface), borehole readings for gamma-emitting contamination, and soil sampling for radionuclides. These data are shown in Table 3 (Bechtel, 1988).

Results of sampling from the Berkeley Khoury League Park recreational area indicated that the concentrations, in soils, of U-238 were 10 pCi/g; Th-230, 20 pCi/g; and Ra-226, 2 pCi/g.

Railroad

The ditches running along the boundary of the SLAPS were sampled by measurements in boreholes for the presence of gamma-emitting radioactive materials and soil samples. The major contaminant in these areas was Th-230, present at a maximum concentration of 15,000 pCi/g. The U-238, Th-232, and Ra-226 concentrations were 94 pCi/g, 6 pCi/g, and 130 pCi/g, respectively. These maximum contaminant levels were found in surface soils (a maximum depth of 1 foot).

Banshee Road borders the SLAPS on the southern boundary. The sampling of this area included 48 boreholes and sampling of surface soils. Two areas showed elevated levels of Th-230 (34 pCi/g) with U-238 (<46 pCi/g), Th-232 (<7.1 pCi/g) and Ra-226 (<7.1 pCi/g) also present.

Airport Property

No off-site air sampling data for Rn-222 were supplied.

Results of general sampling of biota along ditches near the creek showed that Ra-226 ranged from 0.008 to 0.2 pCi/g, Th-232 ranged from 0.0004 to 0.003 pCi/g, and U-238 ranged from 0.02 to 0.16 pCi/g (Bechtel, 1983).

C. Quality Assurance and Quality Control

In preparing this preliminary health assessment, the ATSDR relies on the information provided in the referenced documents. The ATSDR assumes that adequate quality assurance and quality control measures were followed with regard to chain-of-custody, laboratory procedures, and data reporting. The validity of the analyses and conclusions drawn for this preliminary health assessment is determined by the availability and reliability of the referenced information.

In order to identify other possible facilities that could contribute to the release of contaminants into the environment near the SLAP site, ATSDR searched the most recent data contained in the Toxic Chemical Release Inventory (TRI). TRI is developed by the EPA from the chemical release (air, water, and soil) information provided by specified industries. In searching the data base by zip code, there were no reporting facilities in the same zip code as the SLAP site that released either radioactive materials or heavy metals to the environment.

D. Physical and Other Hazards

The three areas composing the NPL site are fenced and placarded as a radiation area. There are no physical hazards at these areas. The baseball field is not part of the NPL site, but the city of St. Louis has closed the field and placed signs stating the area is closed. The area is not fenced and access is not controlled.

PATHWAYS ANALYSES

A. Environmental Pathways (Fate and Transport)

The Coldwater Creek flows through or forms the boundary of the SLAPS areas. There is no known use of the creek for recreational purposes or as a water source near the site. The creek, 19 miles in length, originates about 3.5 miles south of SLAPS, flows for about 500 feet along the western boundary of the site, and then flows into the Missouri River about 15 miles northeast of the SLAPS area (FUSRAP, 1989). The river serves as the area's source of potable water, with the nearest water treatment facility on the Missouri River above the confluence of the creek with the river. The SLAPS was used without liners or a leachate collection system, and runoff has entered the creek. Surface water runoff ultimately flows into Coldwater Creek by direct overland flow or by drainage ditches into the creek that flows north-northeast into the Missouri River.

There are two groundwater systems at the SLAPS. The upper zone is composed of a wind deposit or an eolian layer and a lacustrine or lake deposit. The lower zone is composed of the lake deposit material only. Separating the upper and lower zone is a deposit of legislature silty clay (Bechtel, 1986). The underlying aquifer is alluvial and approximately 25 feet below the surface, is estimated to be 100 feet thick, and includes clay, silt, and gravel deposits. The depth to the water table ranges from 25 to 35 feet. The water from the system is saline, and wells produce low volumes of water. There is no known use of the aquifer within a 3-

mile radius of the site.

Leaching from the soil to the groundwater has occurred. It is unknown if the groundwater, which is believed to flow toward Coldwater Creek, discharges into the creek.

The air pathway includes ionizing radiation, Rn-222, and the possible exposure from airborne dusts contaminated with radioactive substances or heavy metals. The ionizing radiation can easily penetrate air and nominal thickness materials with no or very little attenuation. Rn-222 is an inert, radioactive gas and migrates easily through air. The decay products of radon are particulate and can electrostatically attach to the dust particles.

There are no identified pathways for exposure from potentially contaminated biota. No commercial or private crops are grown in the area and no hunting or fishing is likely to occur in these areas.

B. Human Exposure Pathways

The surface water and groundwater near SLAPS are not used for water sources in the area, therefore, these pathways are not considered viable routes for exposure. Furthermore, the EPA drinking water standards (40 CFR 141) for radioactive materials are not exceeded in Coldwater Creek.

The exposure to ionizing radiation in the areas, although elevated in some sites, is not of concern because of the small amount of time a member of the public would spend in the areas of higher radiation.

The concentrations of Ra-226 and Th-230 at on-site locations are above the EPA and DOE limits of 5 pCi/g from 0 to 15 cm and 15 pCi/g over any 15 cm of soil beneath the surface (40 CFR 190-192). Since these areas are now fenced and covered with clean fill, this exposure route is not of great concern. There is concern, however, with the soil concentrations at the off-site Latty Properties because access to these areas are not as restricted as that of the SLAPS, HISS, and FUTURA areas. Many of these properties are businesses with public access areas.

The release of Rn-222 from the soils into the air at the SLAPS exceeds the regulations of DOE for FUSRAP sites (3.0 pCi/L) and poses an inhalation hazard to on-site personnel. Atmospheric dispersion of Rn-222 from these sites is expected to reduce the levels of Rn-222 to approximately background levels (0.3 pCi/L) and no adverse health effects would be expected in those individuals occupying nearby homes and businesses. Radon, however, does become a potential health hazard when present in elevated levels inside inhabited structures such as homes and businesses. From the information reviewed for this public health assessment, ATSDR does not have any indication that material from the SLAPS was ever used for fill around foundations, potentially increasing the concentration of indoor radon.

The elevated levels of the heavy metals antimony, beryllium, cobalt, nickel, selenium, and lead at the SLAPS, although of some public health concern, are not considered an imminent threat since the contaminated area is fenced and there is no public access.

Inhalation or ingestion of airborne contaminants associated with dusts potentially generated either at the on-site locations or, to a lesser degree, from the off-site locations, can result in radiation exposure to the respiratory system and, to a lesser degree, exposure to the gastrointestinal tract.

Additional inhalation and ingestion of soil contaminants may have occurred during the use of the recreational fields when fugitive dusts were generated during athletic events. Because the haul roads associated with these sites are known to be contaminated with radioactive materials, exposure to human populations may have occurred during remediation of the roads in 1986 and during use of the roads by commercial and private vehicular traffic.

PUBLIC HEALTH IMPLICATIONS

A. Toxicological and Radiological Evaluation

The evaluation of toxicological and radiological properties of contaminants and their effects on human health depends on a variety of factors. First, a person must be exposed to a chemical by coming in contact with it, and with certain types of radiation, by being in the vicinity. Second, the type and severity of adverse health effects resulting from an exposure to a contaminant depends on the concentration, the frequency and/or duration of exposure, the route of exposure, if the exposure was to a single contaminant or a mixture of contaminants and if there were multiple exposures.

For chemicals, the route of exposure can include breathing, drinking, eating, or dermal (skin) contact with a substance that contains the contaminant. In the case of ionizing radiation, the energy can pass through solid matter. A combination of contaminants can result in synergistic actions, where the simultaneous action of the separate compounds together, have a greater total effect than the sum of their individual effects.

The opposite is also a possibility whereby the combination of contaminants can act antagonistically, with one contaminant acting in opposition to or counteracting another contaminant. A third situation could result with the contaminants having no effect on each other.

Once an exposure has occurred, characteristics such as age, sex, race, socioeconomic status, genetics, lifestyle, and health status of the exposed individual influence how the individual absorbs, distributes, metabolizes, and excretes the contaminant. All these factors and characteristics are considered when determining the health effects that may occur as a result of exposure to a contaminant.

The contaminants of concern at SLAPS are Rn-222 (radiological half-life of 3.8 days) and Th-230 (radiological half-life 75,400 years). Chemically, these contaminants pose no health threat. Because of the type of radiation these radionuclides emit--alpha particles and gamma rays--the greatest public health concern arises from inhalation or ingestion of the material.

Radon-222 (Rn-222):

Rn-222 measurements at the SLAPS site ranged from bkg to 6.8 pCi/L and at HISS, the Rn-222 ranged from bkg to 3.4 pCi/L. As previously stated, the DOE FUSRAP limit for Rn-222 emissions is 3 pCi/L. The EPA recommends that Rn-222 not exceed 4 pCi/L in residential areas. There were no reported measurements for off-site areas. However, the outdoor levels of Rn-222, although above average background levels are approximately equal to the concentration many homes across the nation.

Rn-222 has been shown to be carcinogenic when inhaled, producing lung cancers. Most of these studies have involved uranium miners because radon is present at high concentrations in these mines. Although the gas itself is inert, some will be absorbed into the blood from the lungs and transported through the body (ATSDR, 1989a). However, the radon decay products are charged particulates in nature and will electrostatically deposit on lung surfaces. As these products decay further, many emit alpha particles that are completely absorbed in the structures containing the radon decay products. These particles are the major health hazard from exposure to radon gas. The National Council on Radiation Protection and Measurements (NCRP) estimates the annual dose from radon to the bronchial epithelium is 190 millirads for males and 10 year old children and 170 millirads for females (a rad is an estimate of the radiation exposure actually absorbed by a body). The lifetime risk of developing lung cancer from the inhalation of radon at a concentration of a picocurie per cubic meter is estimated at 0.21 per 100,000 population. It is estimated that the annual exposure to radon alone exceeds the exposure to all other naturally occurring sources of radioactivity (NCRP, 1984).

Thorium-230 (Th-230):

The concentration of Th-230 in soils at these sites is in the picocurie range and 1 picocurie of Th-230 has a

mass of 48 x 10^{-12} grams (picograms). This amount of thorium is not considered a chemical hazard. The Annual Limit on Intake for Th-230 is 15 pCi via inhalation. In soils, the maximum reported on-site concentration was 2,600 pCi/g; whereas the maximum reported off-site concentration was 15,000 pCi/g in the ditches associated with the railroad areas.

Mice exposed to milligram amounts of thorium per cubic meter for 18 weeks showed no compound-related mortality. Similar types of studies with rats, guinea pigs, rabbits, and dogs resulted in similar findings. There have been no studies with humans concerning systemic exposures to thorium alone. A statistically significant excess of deaths resulting from pancreatic cancer has been reported in former thorium workers exposed to 0.13 milligrams/cubic meter (ATSDR, 1989b). Based on the amount of thorium present at these areas, the greatest hazard is the internal exposure to alpha particles and other radiations emitted from Th-230. The committed whole body dose equivalents (the radiation dose delivered over a 50-year period following intake of a specific radioactive substance) for this radioisotope are approximately 0.32 x 10^{-3} rem per picocurie inhaled and 0.54 x 10^{-3} rem per picocurie ingested (USEPA, 1988).

Appendix A gives the DOE calculations for individuals using the recreational fields. The ATSDR has reviewed these calculations, and ATSDR's calculations were higher than those calculated by the DOE (ATSDR-15 mrem; DOE-6.5 mrem). ATSDR agrees with the initial calculation of the amount of contaminated dust inhaled. The difference in calculations appears to be in the amount of dust potentially ingested by a ball player. The DOE did not estimate the ingestion of soils by a person sliding into a base in the contaminated areas but used a value of 100 milligrams of soil ingested. The ATSDR used a value of 1 gram of soil being ingested which would account for the increase in the committed dose.

B. Health Outcome Data Evaluation

The National Academy of Sciences BIER V report estimates the risk of excess cancer mortalities related to these types of radiation exposure at 5 excess deaths per 1000 exposed population (NAS, 1990).

In response to the 1988 request at five hazardous waste sites in the St. Louis area, the MDOH conducted a health statistics review of mortality and incidence data by census tract and zip code. The mortality data were obtained from death certificates submitted to the State Center for Health Statistics. Incidence data were obtained from the MCR. In reviewing the mortality and incidence data MDOH had not discovered any excess of cancer.

Following a 1989 report of excess cancer adjacent to HISS, the MDOH, Bureau of Smoking, Tobacco, and Cancer opened an investigation by collecting information on the reported cancer cases and interviewing residents, relatives of cancer victims, and cancer victims to determine if any other cancer cases had occurred near the site. In February 1989, based on confirmation of cancer cases reported and knowledge of radioactive contamination at the waste sites in the area, the MDOH Cancer Inquiry Committee recommended expanding the inquiry.

The expanded inquiry included further interviews of residents and former residents, examination of medical records, and construction of chronology of deposition of radioactive materials, and chronologies of diagnosis dates and time residence of the cancer patients. Statistical tests used to evaluate the data were limited by incomplete information on the total number of residents who lived in the area during the last few decades, their ages, and how long they lived in the area, and by the small number of people and cancer cases on the street. Another problem in determining whether or not a cancer excess or a cancer cluster exist is the existence of several different kinds of cancer among the cases. A cancer cluster is used to describe a grouping of a number of cases of the same type of cancer that may be due to the same cause. Different types of cancer generally have different causes, it is usually unlikely that a grouping of different types of cancer would arise from the same cause. The MDOH was unable to confirm whether or not there is an excess number of cancers in the area and to determine the likelihood residence were exposed to types, quantities, and durations of radiation that would have induced the identified cancers.

Members of the Division of Health Studies, ATSDR, have met with MDOH and investigated these reports excess cancer. As a result of this investigation, ATSDR reviewed the MDOH health statistics review and cancer inquiry. ATSDR concluded that due to the lack of similarity with regard to site and histologic type, the reported cancer cases do not constitute a cancer cluster. In addition ATSDR concluded there is insufficient data to determine an increase incidence of cancer in the Hazelwood neighborhood or whether the identified cancers cases could be attributed to radiation exposure. Furthermore, the types of cancers in the Hazelwood area are not normally associated with exposure to alpha emitters found at this site but with exposure to gamma radiation.

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CONCLUSIONS

Based on the information reviewed, the ATSDR considers the St. Louis Airport/Hazelwood Interim Storage/Futura Coatings Company NPL site to be an indeterminate public health hazard. Emission of Rn-222 into the air and the presence of Th-230 in off-site soils are considered the primary contaminants of concern for their presence could result in humans inhaling and ingesting these contaminants.

RECOMMENDATIONS

A. Recommendations and HARP Statement

Site Characterization Recommendations

1. Characterize groundwater, surface water, sediment, and soil for chemical (non-radiological) contamination on and off site.

2. Characterize off-site surface soil and air for radiological contaminants, in particular Th-230 in soil and Rn-222 in the air. Collect surface soil and air samples from roads used to transport contaminated material to and from these sites prior to remediation and from the baseball field.

Cease/Reduce Exposure Recommendations

1. Implement dust control measures during remediation to reduce the generation of airborne dust which would reduce the likelihood of internal deposition of radioactive material.

Health Activities and Recommendation Panel (HARP) Statement

The public health assessment for St. Louis Airport/Hazelwood Interim Storage/Futura Coatings Company was reviewed by the HARP on January 16, 1992. Based on the recommendations of the panel, it is proposed that the following statement be included in the public health assessment.

> The data and information developed in the St. Louis Airport/Hazelwood Interim Storage/Futura Coatings Company public health assessment were evaluated by the ATSDR Health Activities and Recommendation Panel (HARP) for follow-up health actions. Since human exposure to on-site contaminants may have occurred in the past, HARP has considered this site for follow-up health studies. After consultation with Regional EPA staff and State and local health and environmental officials, the Division of Health Studies, ATSDR, has determined that follow up public health actions or studies are appropriate for this site. Also since the citizens in the vicinity of the sites are concerned with their potential exposure and potential adverse health occurrence, HARP has considered this site for community health education follow up.

B. Public Health Actions

The public health action plan for the St. Louis Airport/Hazelwood Interim Storage/Futura Coatings Company NPL site describes actions planned by ATSDR, DOE, or other state or federal agencies following completion of the public health assessment. The purpose of the public health action plan is to ensure that this public health assessment not only identifies public health hazards, but provides a plan of action designed to mitigate and prevent adverse human health effects resulting form exposure to hazardous in the environment. Included, is a commitment by ATSDR to follow up on this plan to ensure that is implemented. The public health actions to be implemented are as follow.

Public Health Action Taken

1. The Missouri Department of Health conducted a health statistics review of mortality and incidence data, a preliminary cancer inquiry, and a expanded cancer inquiry in the area of the sites.

2. The MDOH informed the residents in the area of the sites of their conclusions and recommendation of the MDOH health statistics review and cancer inquiries regarding the possibility of excess cancer.

3. ATSDR, Division of Health Studies, reviewed the MDOH health statistics review and cancer inquiries. Based on the data provided ATSDR could not demonstrate a cancer cluster, an increased incidence/prevalence of cancer, or any association between the residential area and cancer.

4. DOE conducted additional off-site soil sampling at SLAPS, ditches north and south of SLAPS, ball field area, Banchee Road, SLAPS vicinity properties, haul roads, HISS, and HISS/Futura vicinity properties. These samples were analyzed for radiological contaminants, and organic and metal contaminants using the Toxicity Characteristic Leaching Procedure (TCLP).

5. DOE conducted additional groundwater sampling at SLAPS, HISS, and vicinity properties. Samples were analyzed for radiological contaminants, volatile organic compounds, semi-volatile organic compounds, and metals.

Public Health Actions Planned

1. ATSDR, Division of Health Assessment and Consultation, will review the additional off-site soil and groundwater data collected by DOE and determined the public health implication.

2. The MDOH will periodically conduct follow-up assessments of cancer incidence in the area of the site.

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TABLE 1. ENVIRONMENTAL SAMPLING DATA AS REPORTED
IN 1988 FOR THE ST. LOUIS AIRPORT STORAGE SITE[1]

Contaminant	Groundwater	Surface Water	Sediment	Soils[2]
Uranium	5,500 pCi/L	0.4 pCi/L	1.7 pCi/g	1,600 pCi/g[3]
Th-232	ND[4]	ND	ND	63
Th-230	50	background	4.1	2,600
Ra-226	1	background	background	5,600

1 - The Maximum contaminant level for these radionuclides in drinking water is 5 pCi/L for radium and 15 pCi/L for gross alpha activity except for uranium.

2 - The concentration of thorium and radium in soils should not exceed 5 pCi/g above background over the first 15 cm of depth and 15 pCi/g averaged over 15 cm at depths greater than 15 cm (40 CFR 192). There are no standards for the concentration of uranium in soils.

3 - Value is for Uranium-238

4 - No Data

TABLE 2. ENVIRONMENTAL SAMPLING DATA AS REPORTED
IN 1988 FOR THE HAZELWOOD INTERIM STORAGE SITE[1]

Contaminant	Groundwater	Surface Water	Sediment	Soil[2]
Uranium	87 pCi/L	5 pCi/L	1.7 pCi/g	800 pCi/g[3]
Th-232	ND[4]	ND	ND	5
Th-230	64	0.9	4.8	750
Ra-226	3.7	0.3	1.2	700

1 - The Maximum contaminant level for these radionuclides in drinking water is 5 pCi/L for radium and 15 pCi/L for gross alpha activity except for uranium.

2 - The concentration of thorium and radium in soils should not exceed 5 pCi/g above background over the first 15 cm of depth and 15 pCi/g averaged over 15 cm at depths greater than 15 cm (40 CFR 192). There are no standards for the concentration of uranium in soils.

3 - Value is for Uranium-238

4 - No Data

TABLE 3. OFF-SITE RADIONUCLIDE LEVELS AS REPORTED IN 1988 FROM THE LATTY PROPERTIES

Location	U-238	Th-232	Th-230	Ra-226
Wagner Electric Corporation	18 (1)	5 (1)	810 (0.5)	11 (0.5)
General Investment Fund	100 (0.5)	5 (5)	5,700 (0.5)	89 (0.5)
Crow-St. Louis	< 20 (8)	4 (8)	460 (0.5)	10 (0.5)
SLT Warehouse Company	< 39 (2)	5 (5)	15 (1)	4 (2)
Graham Engineering Corporation	< 30 (8)	7 (8)	12 (0.5)	4 (8)

Values are expressed in pCi/g soil with the value in parenthesis the depth, in feet, at which that level of contamination was found.

TABLE 4. MAXIMUM CONTAMINATION LEVELS AS REPORTED IN 1990 ALONG THE HAUL ROADS ASSOCIATED WITH THE SLAP NPL SITE

Location	U-238	Th-232	Th-230	Ra-226
Latty Avenue	48.2 (1.5)	9.5 (2)	1,413	39.9 (1.5)
McDonnell	59 (0.5)	9 (8)	2,900 (0.5)	64 (0.5)

Boulevard				
Hazelwood Avenue	72 (0.5)	9 (2)	4,810 (0.5)	42 (0.5)
Pershall Road	73 (0.5)	8 (1)	4,900 (0.5)	92 (0.5)

Values are expressed in pCi/g soil with the value in parenthesis the depth, in feet, at which that level of contamination was found.

LIST OF FIGURES

Figure 1. Location of the SLAP, HIS, and Futura sites

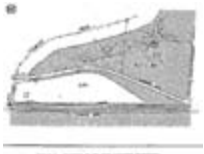


Figure 2. Location of the SLAP vicinity properties

Figure 3. Boundaries of the HIS and Futura sites

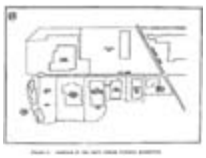
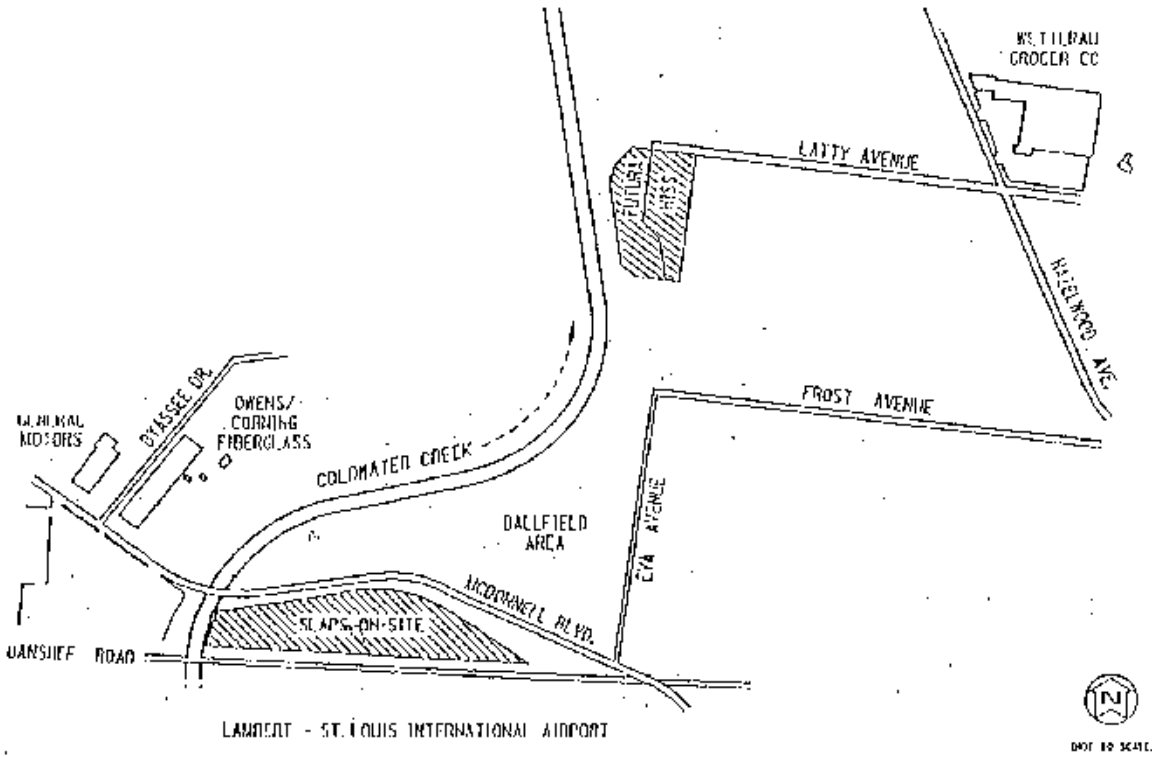


Figure 4. Location of the Latty Avenue vicinity properties



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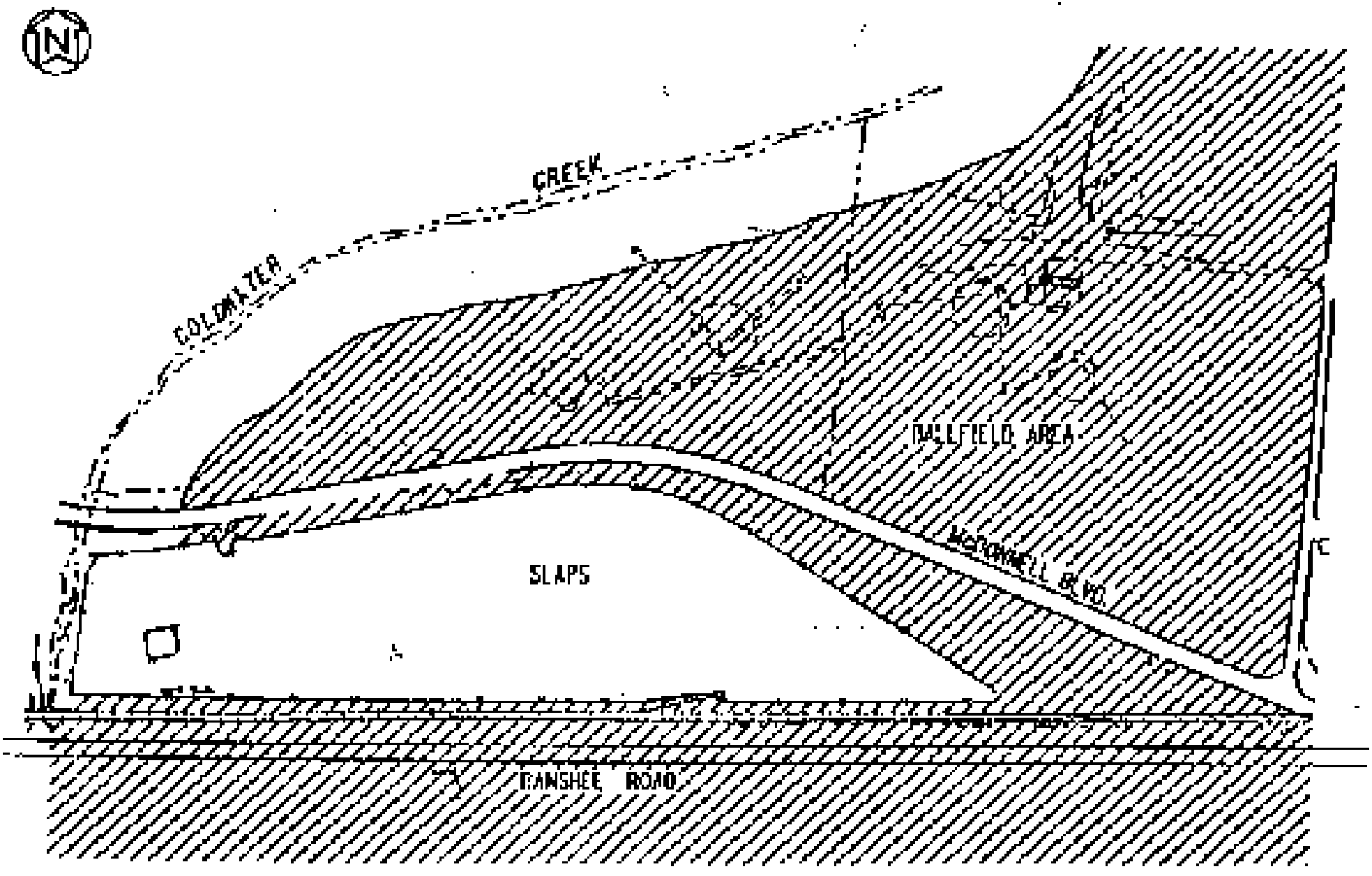
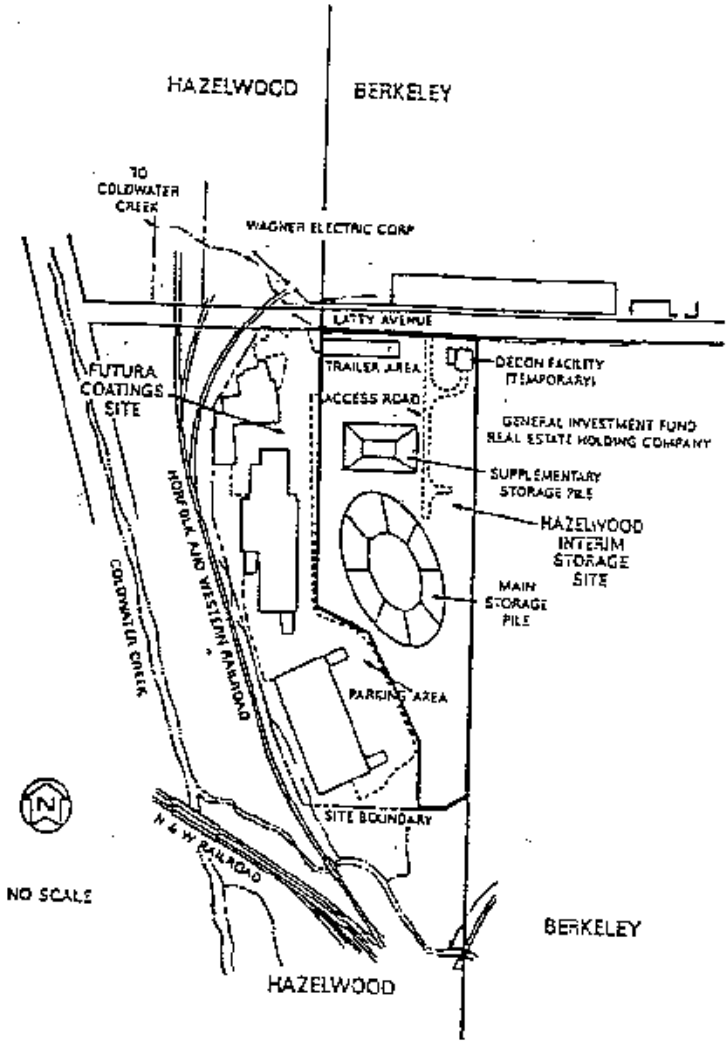


Figure 2. Location of the SLAP vicinity properties



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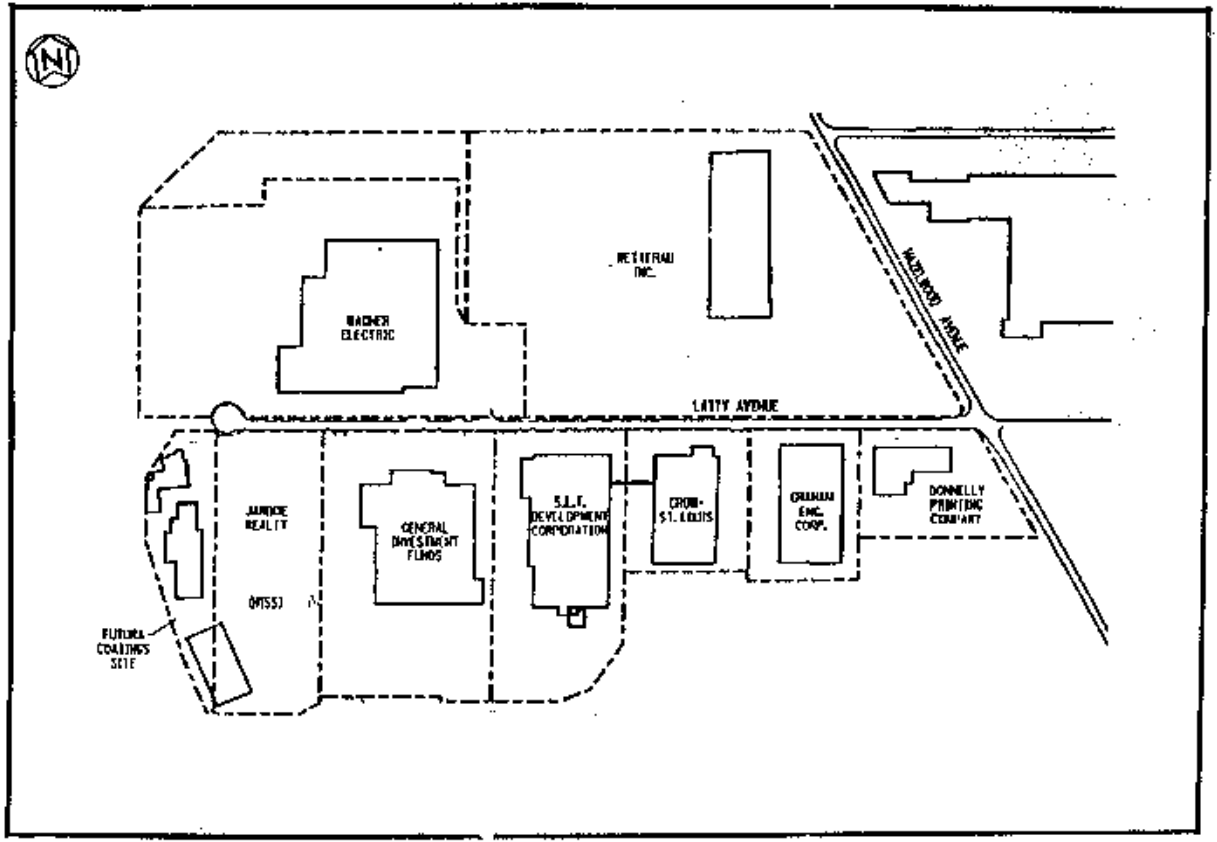

Figure 4. Location of the Latty Avenue vicinity properties

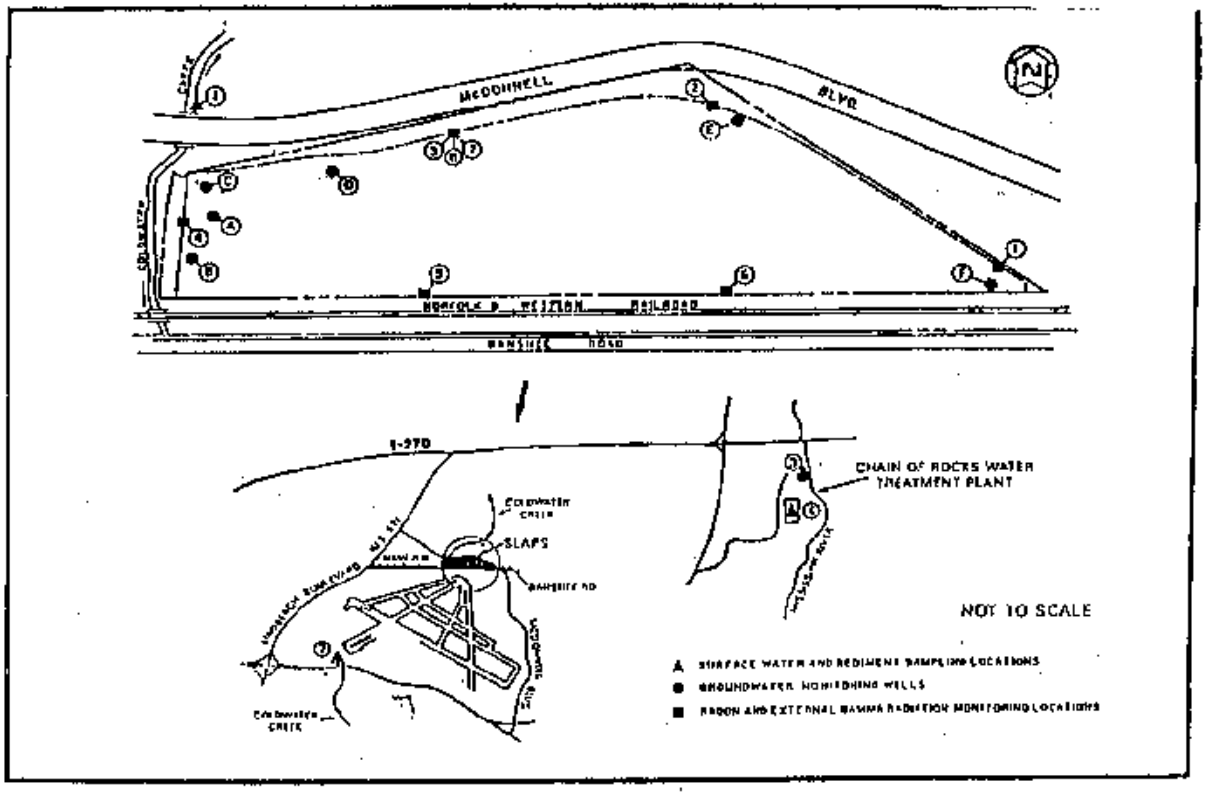

Figure 5. SLAPS environmental monitoring locations

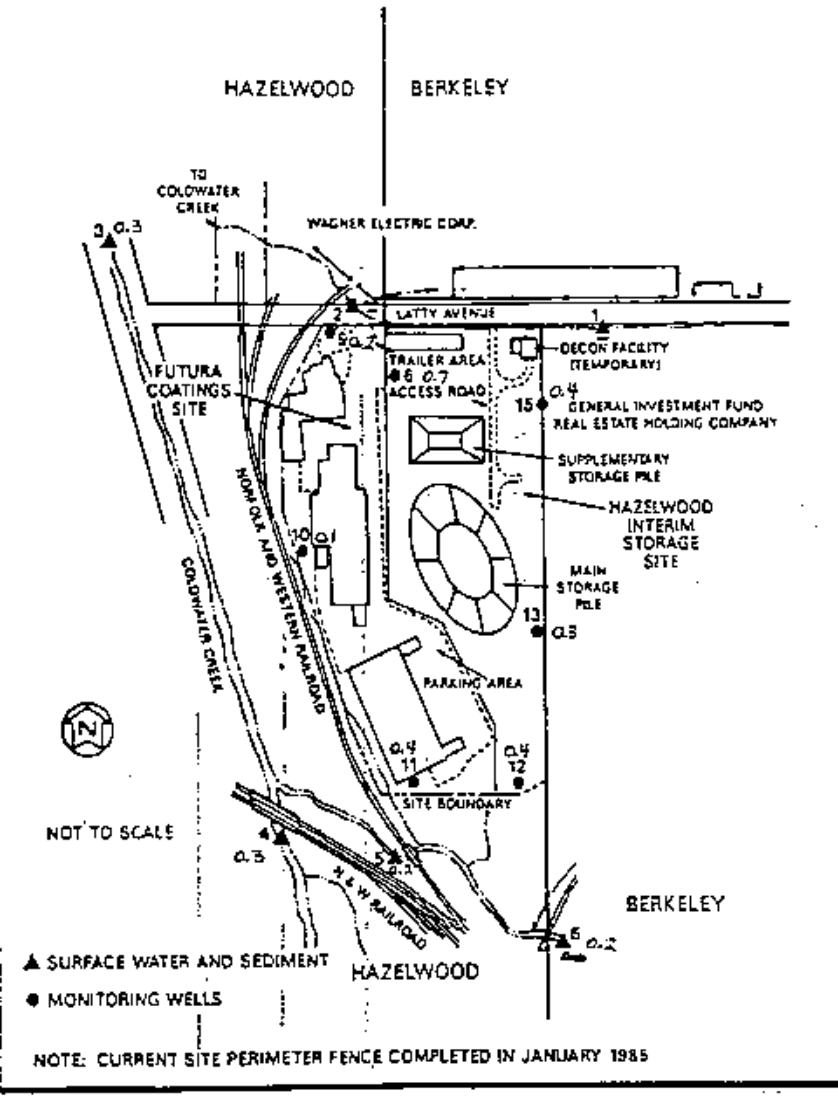

Figure 6. Surface water, groundwater, and sediment sampling locations at the HISS

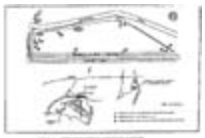

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Figure 6. Surface water, groundwater, and sediment sampling locations locations at the HISS

APPENDIX A - DEPARTMENT OF ENERGY DOSE CALCULATIONS

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APPENDIX B - PUBLIC COMMENTS

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APPENDIX C - ATSDR RESPONSE TO PUBLIC COMMENTS

ATSDR received comments from eight sources concerning the St. Louis Airport, Hazelwood Interim Storage, Futura Coatings Company in St. Louis, Missouri. The comment period for this health assessment was published in the St. Louis Post-Dispatch and an article in the newspaper appeared on Tuesday, May 14, 1991. The comment period ran from May 15 to June 13, 1991. The responses were entered into a tracking system, photocopied, and distributed to the health assessment author. Where multiple comments from an individual were received, the comments were numbered. For Appendix B, all personal identifiers were removed from the comments received and placed in chronological order. The comments are addressed in chronological order as received.

May 30, 1991

1. The ATSDR Health Assessment for the St. Louis Airport, Hazelwood Interim Storage, Futura Coatings Company is written for several audiences, both technical and public. The technical audience includes the U.S. Environmental Protection Agency (EPA), other federal agencies involved with the site, state agencies, and the parties responsible for the site (owners or caretakers). In this respect the technical aspects of the assessment are a necessity. Because of the technical nature, ATSDR has attempted to structure certain sections of the health assessment to the public. These sections include the Summary, Human Exposure Pathways, and the Public Health Implications.

2. The determination of the size of a population that would be necessary to detect an increase in cancers is risk analysis. The National Academy of Science in their Biological Effects of Ionizing Radiation report (BEIR V) did publish risk factors for excess cancer mortalities for populations exposed to ionizing radiation. In a population of 100,000 males exposed over a lifetime to 100 mrem per year, the excess cancer mortality rate is estimated to be on the order of 520 excess deaths. For females under these same conditions, the excess death from cancer was estimated to be 600 individuals. However, there is much disagreement among radiation specialists as to the long term health effects of low doses of radiation. A statement of these studies has been included in the Public Health Implications section.

3. ATSDR believes that the commenter's remarks concerning radon stand on its own merit. A statement has been added in the Toxicological Implications section.

4. The dose calculations of ATSDR and DOE indicate the potential dose deposited directly to the bone surface after the internalization of radioactive materials. This dose is above and beyond that which might be received from the naturally occurring background radiation. ATSDR disagrees with the comment that "it is also considerably smaller than differences in radiation exposures due to the varying radon levels in a home." The National Council on Radiation Protection and Measurements (NCRP) in Report 78 state that the lung dose as a result of radon is low. However, the major lung damage is from the radon decay products. The NCRP estimates that the average dose to the lung bronchial epithelium for adults is 180 mrad per year and for a 10 year old the average dose is 300 mrad per year. These doses are 10 to 20 times higher than the bone doses calculated by ATSDR or DOE.

5. A response to this question requires a comparative risk assessment which is not in the purview of ATSDR.

6. The 15 mrem estimate was calculated using current methodology and data of the International Commission on Radiological Protection. The variation for these calculations is determined by the amount of contaminated soil a ball player might receive if they ingested a gram of soil. In some cases, it is conceivable that a very intense ball player may have ingested much more than a gram; however, it is believed that the average ball player would ingest much less. ATSDR is not aware of any studies involving soil ingestion in athletic events.

7. ATSDR has developed a Public Health Assessment Guidance Manual which describes five levels of public health concern. At the time this health assessment was prepared, the St. Louis Airport Site would have been classified as a Potential Public Health Hazard. Under the new guidance manual, the site has been reevaluated and upgraded to an Indeterminate Public Health Hazard. The manual states that this category is used for sites in which there is incomplete information. Although ATSDR believes humans have been exposed to levels of contaminants that could cause adverse health effects, data or information from this site are not available for all environmental media, such as biota, to which human may have been exposed.

8. It is the opinion of ATSDR that an estimate of the number of person-sieverts would not be beneficial for this site. This is because exposure depends on many factors including those related to life styles, use of the environment around the site, and in some instances, biological aspects. The International Commission on Radiological Protection Report 26, paragraph 219 states that "because of its complexity, assessments of collective dose equivalent involve the use of simplifications and

approximations, particularly when a large population is irradiated at low dose levels. Because of this, they may involve considerable uncertainties and these must be borne in mind when the assessments are being used to appraise the detriment associated with a practice."

A response to the cost benefit analysis requires a risk assessment which is not in the purview of ATSDR.

June 7, 1991

ATSDR believes that the commenter's remarks concerning this site stand on its own merit.

June 10, 1991 (a)

1. The ATSDR health assessment is not designed to generate new data for an existing site. However, the health assessment is to review the existing documents associated with a site. This information is garnered from government and public documents and comments from citizens. The health assessment does not serve as an epidemiological study, but it can suggest that an epidemiological study be considered. This indeed has been stated in the Recommendations section of the health assessment as the site is being considered for follow-up health studies.

   Although it is true that radiation can cause genetic disorders, radiation is not specific for male or female genes. In cases of Down's Syndrome where there is a breakage and realignment of human chromosome 21, the radiation doses resulting in chromosome breakage are orders of magnitude higher that those found at this site.

2. The majority of the radioactive materials found at this site are predominately alpha emitters with an emission of gamma radiation associated with the decay. Many of these resulting gamma ray emissions are very weak and are easily diminished in air. In cases of internalization of alpha emitters, the damage resulting from alpha radiation is twenty times more serious than damage resulting from gamma radiation. When alpha emitters, such as those found at this site, are internalized, they can result in bone cancers or lung cancer. In the case of radon exposure, it is not the radon that causes the most damage, but the alpha particles resulting from the decay of the radon progeny.

3. ATSDR believes that the commenter's remarks concerning this site stand on its own merit.

4. ATSDR believes that the commenter's remarks concerning this site stand on its own merit.

June 10, 1991 (b)

ATSDR believes that the commenter's remarks concerning this site stand on its own merit.

June 12, 1991 (a)

An additional statement has been added to Part C. DEMOGRAPHICS, LAND USE, AND NATURAL RESOURCE USE indicating that some neighborhoods may use the creek for recreational purposes.

June 12, 1991 (b)

1. This comment has been addressed in the Summary section and the Background section of the health assessment.

2. Uranium-235 is found at the site; however, its concentration in the waste piles is low. Uranium-235 can be the main component in nuclear weapons or reactors and because of its value, is rarely disposed of as waste. The term enriched uranium refers to the chemical and physical processes whereby the amount of uranium-235 in natural uranium (0.3 percent) is amplified to a higher or enriched amount of uranium-

235. This enriched uranium can then be used as previously described. The health effects of uranium-235 are believed to be the same as natural uranium in which the chemical toxicity resulting in renal damage is the major cause for concern.

Radon-219 is a decay product of uranium-235, although present at the site was not discussed in the health assessment because of its short half-life, 3.96 seconds. After 40 seconds, the amount of radon-219 remaining is about 0.1 percent of the original amount. Of the decay products of radon-219, the member with the longest half-life is thallium-207 with a half-life of 4.8 minutes. After 48 minutes, the amount of thallium-207 remaining is also 0.1 percent of the original amount. In fact, if you speculate that the waste uranium-235 has been at the site for 25 years, then the ratio of radon-219 present with respect to the uranium-235 is 1/443,000 of uranium-235.

3. ATSDR believes that the commenter's remarks concerning this site stand on its own merit.

4. ATSDR believes that the commenter's remarks concerning this site stand on its own merit.

June 13, 1991 - Missouri Department of Health

1. ATSDR addresses this comment in the Health Outcome Data Evaluation section of the public health assessment. ATSDR believes that the commenter's remarks concerning this site stand on its own merit.

2. ATSDR addresses this comment in the Health Outcome Data Evaluation section of the public health assessment. ATSDR believes that the commenter's remarks concerning this site stand on its own merit.

June 13, 1991

1. ATSDR believes that the levels of radionuclides found at these sites are high levels from an environmental point of view as many samples exceeded ambient background levels of the St. Louis, Missouri area.

2. The spelling correction for Futura has been made in the health assessment. The properties in question have now been referred to Latty Avenue Vicinity Properties. The figure in question was derived from a draft document released by Bechtel in 1988.

3. The health assessment has been corrected to reflect the commenter's concern.

4. The health assessment stated that materials had been placed in a second pile. The initial reference (Bechtel, 1987a) stated that materials were stored in a supplementary pile at HISS. The health assessment has been corrected to reflect the commenter's concern.

5. ATSDR believes that the commenter's remarks concerning this site stand on its own merit.

6. The values in the health assessment were derived from Tables I1-I12 of Bechtel document. The values in those tables for each month were averaged over the 12-month period and the averages reported in the health assessment.

7. ATSDR believes that the commenter's remarks concerning this site stand on its own merit.

8. ATSDR believes that the commenter's remarks concerning this site stand on its own merit.

9. The health assessment has been corrected to reflect the commenter's concern.

10. The health assessment has been corrected to reflect the commenter's concern.

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